SEQUENCE LISTING

<110> BASF Aktiengesellschaft

<120> GMP synthetase from plants

<130> DE 19947490.7

<140> 0050-50777
<141> 1999-10-01

<160> 4

<170> PatentIn Vers. 2.0

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<212> DNA
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Met Glu Pro Gln Thr Gln Ala Lys Lys Ser Asn Leu Val Leu Ile
1 5 10 15

cta gac tac ggt tct cag tac act cac cta atc acc cgc cga atc cga 157
Leu Asp Tyr Gly Ser Gln Tyr Thr His Leu Ile Thr Arg Arg Ile Arg
20 25 30

agc cta tca att ttc tca ctc acc att aac ggc acc tct tcg tta gac 205
Ser Leu Ser Ile Phe Ser Leu Thr Ile Asn Gly Thr Ser Ser Leu Asp
35 40 45

tcc ata aaa gaa ctc gac cca cgt gtc att atc ctc tcg ggt gga ccc 253
Ser Ile Lys Glu Leu Asp Pro Arg Val Ile Ile Leu Ser Gly Gly Pro
50 55 60

cac agc gtc cac gct gac ggc gca ccg tgt ttc cca cct ggg ttc atc 301
His Ser Val His Ala Asp Gly Ala Pro Cys Phe Pro Pro Gly Phe Ile
65 70 75

gaa tac gtc gag tca cgt ggg att cac gtg ttg ggt ata tgt tat ggg 349
Glu Tyr Val Glu Ser Arg Gly Ile His Val Leu Gly Ile Cys Tyr Gly
80 85 90 95

ctg cag ttg att gtt cag aaa ctt ggc ggg gtt gtg aaa att gga gag 397
Leu Gln Leu Ile Val Gln Lys Leu Gly Gly Val Val Lys Ile Gly Glu
100 105 110

aaa cat gag tat ggg aga atg gaa att gag gtt gga aag aat gtt gtt 445
Lys His Glu Tyr Gly Arg Met Glu Ile Glu Val Gly Lys Asn Val Val

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            115                 120                 125

ggg ggg ttg ttt ggg aat acg gaa att ggt gat aaa cag gtg gtt tgg   493
Gly Gly Leu Phe Gly Asn Thr Glu Ile Gly Asp Lys Gln Val Val Trp
        130                 135                 140

atg agc cac ggt gat gag gct gtg aaa ttg ccg gaa ggg ttt gag gtt   541
Met Ser His Gly Asp Glu Ala Val Lys Leu Pro Glu Gly Phe Glu Val
    145                 150                 155

gtg gcg agg agt agt cag ggt gct gtt gct gct att gag aat cgg gaa   589
Val Ala Arg Ser Ser Gln Gly Ala Val Ala Ala Ile Glu Asn Arg Glu
160                 165                 170                 175

cgg agg ttt tat ggg ctg cag tat cat ccc gag gta acg cac tcg act   637
Arg Arg Phe Tyr Gly Leu Gln Tyr His Pro Glu Val Thr His Ser Thr
                180                 185                 190

gaa ggg atg aga aca tta aga cac ttt ctg ttt gat gta tgt ggc gtt   685
Glu Gly Met Arg Thr Leu Arg His Phe Leu Phe Asp Val Cys Gly Val
            195                 200                 205

aca gct ggc tgg aag atg gaa gat gtt ctg gag gaa gaa ata aaa gtt   733
Thr Ala Gly Trp Lys Met Glu Asp Val Leu Glu Glu Glu Ile Lys Val
        210                 215                 220

atc aaa ggt atg gtt gga cct gaa gat cac gtg att tgt gct tta tct   781
Ile Lys Gly Met Val Gly Pro Glu Asp His Val Ile Cys Ala Leu Ser
    225                 230                 235

ggt ggt gtt gat tcc aca gtt gca gct aaa ttg gta cac aag gct atc   829
Gly Gly Val Asp Ser Thr Val Ala Ala Lys Leu Val His Lys Ala Ile
240                 245                 250                 255

ggg gac agg ctt cac tgt gtt ttt gtt gat aat ggt cta tta agg tat   877
Gly Asp Arg Leu His Cys Val Phe Val Asp Asn Gly Leu Leu Arg Tyr
                260                 265                 270

aag gag aga gaa agg gtg atg gaa ctc ttt gag aag cgc ctt cat ttg   925
Lys Glu Arg Glu Arg Val Met Glu Leu Phe Glu Lys Arg Leu His Leu
            275                 280                 285

cct gtt acc tgt gtc gat gct aca gaa gaa ttt ctc agc aaa cta aaa   973
Pro Val Thr Cys Val Asp Ala Thr Glu Glu Phe Leu Ser Lys Leu Lys
        290                 295                 300

ggc gta aca gaa cct gaa atg aag agg aaa ata att ggg aag gag ttc   1021
Gly Val Thr Glu Pro Glu Met Lys Arg Lys Ile Ile Gly Lys Glu Phe
    305                 310                 315

atc aac ata ttt gat ctt ttt gcc cat gat gtg gag gaa aaa gta ggg   1069
Ile Asn Ile Phe Asp Leu Phe Ala His Asp Val Glu Glu Lys Val Gly
320                 325                 330                 335

aaa aaa cct agt tac cta gtc caa gga acc ttg tat cct gat gta ata   1117
Lys Lys Pro Ser Tyr Leu Val Gln Gly Thr Leu Tyr Pro Asp Val Ile
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aag agc cat cat aat gtt gga ggt ctt cca aag gac atg aag ctg aag   1213
Lys Ser His His Asn Val Gly Gly Leu Pro Lys Asp Met Lys Leu Lys
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ctc atc gag cca ctg aaa ctt cta ttc aag gat gag gtt cgt gaa ttg   1261
Leu Ile Glu Pro Leu Lys Leu Leu Phe Lys Asp Glu Val Arg Glu Leu
    385                 390                 395

gga aag att ttg gat ata tct gag gac ttt ctt aaa cgc cac ccg ttc   1309
Gly Lys Ile Leu Asp Ile Ser Glu Asp Phe Leu Lys Arg His Pro Phe
400                 405                 410                 415

cct ggg ccc gga ctc gct gtg cga att cca ggt gat gtc aca gca ggg   1357
Pro Gly Pro Gly Leu Ala Val Arg Ile Pro Gly Asp Val Thr Ala Gly
                420                 425                 430

aat tcc ttg gat att ctt cgt cag gtt gat gaa atc ttc att caa tca   1405
Asn Ser Leu Asp Ile Leu Arg Gln Val Asp Glu Ile Phe Ile Gln Ser
            435                 440                 445

atc aga gat gct aaa atc tat gat gaa ata tgg caa gct ttt gct gtc   1453
Ile Arg Asp Ala Lys Ile Tyr Asp Glu Ile Trp Gln Ala Phe Ala Val
        450                 455                 460

ttc tta cca gtg aaa act gtt gga gta caa gga gac caa aga acc cat   1501
Phe Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp Gln Arg Thr His
    465                 470                 475

tcc cac gct gtt gca ctt aga gca gtc aca agt caa gat gga atg act   1549
Ser His Ala Val Ala Leu Arg Ala Val Thr Ser Gln Asp Gly Met Thr
480                 485                 490                 495

gca gac tgg tac tac ttt gat ttc aag ttc ctt gac gac gta tca aga   1597
Ala Asp Trp Tyr Tyr Phe Asp Phe Lys Phe Leu Asp Asp Val Ser Arg
                500                 505                 510

aag atc tgc aat agt gtt cgt ggt gta aat cga gtt ctg ctg gat att   1645
Lys Ile Cys Asn Ser Val Arg Gly Val Asn Arg Val Leu Leu Asp Ile
            515                 520                 525

aca tca aag cct cca tca aca atc gaa tgg gaa taatttgtta taaagaatgc 1698
Thr Ser Lys Pro Pro Ser Thr Ile Glu Trp Glu
        530                 535

tatatttggt gaccaaagta ggattctttt gtgatttttg gtgcataaca aaaaggaaga 1758

aaatcataat agaaatttag gtccttttgt tatgtggtag aactggttct tgggtaatta 1818

tgtgcaatgc tctcaacaat tttgtatgtt tatgggtatg atgataccaa attttactca 1878

gatcttggta gtacattttt cttatccaag tatagtaaca tgtggccagg catcaaaagc 1938
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ctattccact caaaaaaaaa aaaaaaaaac tcgag 1973

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<213> Nicotiana tabacum

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             20                  25                  30

Leu Ser Ile Phe Ser Leu Thr Ile Asn Gly Thr Ser Ser Leu Asp Ser
         35                  40                  45

Ile Lys Glu Leu Asp Pro Arg Val Ile Ile Leu Ser Gly Gly Pro His
     50                  55                  60

Ser Val His Ala Asp Gly Ala Pro Cys Phe Pro Pro Gly Phe Ile Glu
 65                  70                  75                  80

Tyr Val Glu Ser Arg Gly Ile His Val Leu Gly Ile Cys Tyr Gly Leu
                 85                  90                  95

Gln Leu Ile Val Gln Lys Leu Gly Gly Val Val Lys Ile Gly Glu Lys
            100                 105                 110

His Glu Tyr Gly Arg Met Glu Ile Glu Val Gly Lys Asn Val Val Gly
        115                 120                 125

Gly Leu Phe Gly Asn Thr Glu Ile Gly Asp Lys Gln Val Val Trp Met
    130                 135                 140

Ser His Gly Asp Glu Ala Val Lys Leu Pro Glu Gly Phe Glu Val Val
145                 150                 155                 160

Ala Arg Ser Ser Gln Gly Ala Val Ala Ala Ile Glu Asn Arg Glu Arg
                165                 170                 175

Arg Phe Tyr Gly Leu Gln Tyr His Pro Glu Val Thr His Ser Thr Glu
            180                 185                 190

Gly Met Arg Thr Leu Arg His Phe Leu Phe Asp Val Cys Gly Val Thr
        195                 200                 205

Ala Gly Trp Lys Met Glu Asp Val Leu Glu Glu Glu Ile Lys Val Ile
    210                 215                 220

Lys Gly Met Val Gly Pro Glu Asp His Val Ile Cys Ala Leu Ser Gly
225                 230                 235                 240

Gly Val Asp Ser Thr Val Ala Ala Lys Leu Val His Lys Ala Ile Gly
                245                 250                 255
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Asp Arg Leu His Cys Val Phe Val Asp Asn Gly Leu Leu Arg Tyr Lys
260 265 270

Glu Arg Glu Arg Val Met Glu Leu Phe Glu Lys Arg Leu His Leu Pro
275 280 285

Val Thr Cys Val Asp Ala Thr Glu Glu Phe Leu Ser Lys Leu Lys Gly
290 295 300

Val Thr Glu Pro Glu Met Lys Arg Lys Ile Ile Gly Lys Glu Phe Ile
305 310 315 320

Asn Ile Phe Asp Leu Phe Ala His Asp Val Glu Glu Lys Val Gly Lys
325 330 335

Lys Pro Ser Tyr Leu Val Gln Gly Thr Leu Tyr Pro Asp Val Ile Glu
340 345 350

Ser Cys Pro Pro Pro Gly Ser Gly Arg Thr His Ser His Thr Ile Lys
355 360 365

Ser His His Asn Val Gly Gly Leu Pro Lys Asp Met Lys Leu Lys Leu
370 375 380

Ile Glu Pro Leu Lys Leu Leu Phe Lys Asp Glu Val Arg Glu Leu Gly
385 390 395 400

Lys Ile Leu Asp Ile Ser Glu Asp Phe Leu Lys Arg His Pro Phe Pro
405 410 415

Gly Pro Gly Leu Ala Val Arg Ile Pro Gly Asp Val Thr Ala Gly Asn
420 425 430

Ser Leu Asp Ile Leu Arg Gln Val Asp Glu Ile Phe Ile Gln Ser Ile
435 440 445

Arg Asp Ala Lys Ile Tyr Asp Glu Ile Trp Gln Ala Phe Ala Val Phe
450 455 460

Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp Gln Arg Thr His Ser
465 470 475 480

His Ala Val Ala Leu Arg Ala Val Thr Ser Gln Asp Gly Met Thr Ala
485 490 495

Asp Trp Tyr Tyr Phe Asp Phe Lys Phe Leu Asp Asp Val Ser Arg Lys
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Ser Lys Pro Pro Ser Thr Ile Glu Trp Glu
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gaa aat gtg gat tcc aga atc tac gcc ctc caa tac cat ccc gag gtt    95
Glu Asn Val Asp Ser Arg Ile Tyr Ala Leu Gln Tyr His Pro Glu Val
                 20                  25                  30

acg cac tca gag aaa ggg aca gag act ttg aga cac ttt ttc ctg aat   143
Thr His Ser Glu Lys Gly Thr Glu Thr Leu Arg His Phe Phe Leu Asn
             35                  40                  45

gtc tgc ggc atg aag gct gac tgg cag atg cag aat gtg ttg gag gaa   191
Val Cys Gly Met Lys Ala Asp Trp Gln Met Gln Asn Val Leu Glu Glu
         50                  55                  60

gag att aaa aag gtc act gcg acc gtc ggc cca gat gat cat gtt att   239
Glu Ile Lys Lys Val Thr Ala Thr Val Gly Pro Asp Asp His Val Ile
     65                  70                  75

tgt gca ctc tcc ggg ggc gtg gac tca aca gta gca gct act ctg gtg   287
Cys Ala Leu Ser Gly Gly Val Asp Ser Thr Val Ala Ala Thr Leu Val
 80                  85                  90                  95

cac cgt gct att gga gat cgc ctt cat tgt gtg ttt gta gat aat ggc   335
His Arg Ala Ile Gly Asp Arg Leu His Cys Val Phe Val Asp Asn Gly
                100                 105                 110

ctt tgc aga tac aag gaa aga gaa aga gtg atg gcc aca ttt gtg aaa   383
Leu Cys Arg Tyr Lys Glu Arg Glu Arg Val Met Ala Thr Phe Val Lys
            115                 120                 125

gac ctt cat ctg cca gtc act tgt gtg gat gcc act gag cag ttt ctc   431
Asp Leu His Leu Pro Val Thr Cys Val Asp Ala Thr Glu Gln Phe Leu
        130                 135                 140

agc aaa ttg aag ggc gtg gta gat cca gag aga aag agg aag atc atc   479
Ser Lys Leu Lys Gly Val Val Asp Pro Glu Arg Lys Arg Lys Ile Ile
    145                 150                 155

gga gca gag ttt att gca gtc ttt gat gaa ttt tcg cac aga ttg gag   527
Gly Ala Glu Phe Ile Ala Val Phe Asp Glu Phe Ser His Arg Leu Glu
160                 165                 170                 175

aga gag att gga aag atg cct gct ttc ctt gtg cag gga aca ctt tat   575
Arg Glu Ile Gly Lys Met Pro Ala Phe Leu Val Gln Gly Thr Leu Tyr
                180                 185                 190

cca gat gtc att gag tcg tgt cct cct cca ggg agc ggg aag tcg cat   623
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Pro Asp Val Ile Glu Ser Cys Pro Pro Pro Gly Ser Gly Lys Ser His
            195                 200                 205

tcc cac aca atc aaa agt cat cac aac gtc ggt ggc ttg ccc gag aac   671
Ser His Thr Ile Lys Ser His His Asn Val Gly Gly Leu Pro Glu Asn
        210                 215                 220

atg aaa ttg aag ttg gtt gag cct ctc aag tgg ctc ttc aaa gac gag   719
Met Lys Leu Lys Leu Val Glu Pro Leu Lys Trp Leu Phe Lys Asp Glu
    225                 230                 235

gta cgc gaa atg ggt gca ttg ttg gat gta cct gtt tcc ttt ttg aag   767
Val Arg Glu Met Gly Ala Leu Leu Asp Val Pro Val Ser Phe Leu Lys
240                 245                 250                 255

cgc cat cct ttc cct gga cct gga ttg gcc gtg cga att ctt ggg gat   815
Arg His Pro Phe Pro Gly Pro Gly Leu Ala Val Arg Ile Leu Gly Asp
                260                 265                 270

gta act cag gac ggc gca ctc gac act atc cgc ttg gtt gat gag atc   863
Val Thr Gln Asp Gly Ala Leu Asp Thr Ile Arg Leu Val Asp Glu Ile
            275                 280                 285

ttt gtg aac agc att cga gag gca ggt ctt tac gat aag atc tgg cag   911
Phe Val Asn Ser Ile Arg Glu Ala Gly Leu Tyr Asp Lys Ile Trp Gln
        290                 295                 300

gca ttt gct gtt tat ctg cca gta aag act gtt ggc gtt caa ggc gac   959
Ala Phe Ala Val Tyr Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp
    305                 310                 315

aaa cgg aca cat tca cac gct gtt gct cta cgt gca att aca agt gaa   1007
Lys Arg Thr His Ser His Ala Val Ala Leu Arg Ala Ile Thr Ser Glu
320                 325                 330                 335

gac gga atg act gct gac tgg ttt cat ttt gat gga aag ttt ctt gcc   1055
Asp Gly Met Thr Ala Asp Trp Phe His Phe Asp Gly Lys Phe Leu Ala
                340                 345                 350

gag gta tca tct aaa atc tgc aac agc gta agg ggt atc aat agg gtg   1103
Glu Val Ser Ser Lys Ile Cys Asn Ser Val Arg Gly Ile Asn Arg Val
            355                 360                 365

gta tac gac att acg tct aaa cct cca tca act gtt gag tgg gaa       1148
Val Tyr Asp Ile Thr Ser Lys Pro Pro Ser Thr Val Glu Trp Glu
        370                 375                 380

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<212> PRT
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            20                  25                  30

His Ser Glu Lys Gly Thr Glu Thr Leu Arg His Phe Phe Leu Asn Val
        35                  40                  45

Cys Gly Met Lys Ala Asp Trp Gln Met Gln Asn Val Leu Glu Glu Glu
    50                  55                  60

Ile Lys Lys Val Thr Ala Thr Val Gly Pro Asp Asp His Val Ile Cys
65                  70                  75                  80

Ala Leu Ser Gly Gly Val Asp Ser Thr Val Ala Ala Thr Leu Val His
                85                  90                  95

Arg Ala Ile Gly Asp Arg Leu His Cys Val Phe Val Asp Asn Gly Leu
            100                 105                 110

Cys Arg Tyr Lys Glu Arg Glu Arg Val Met Ala Thr Phe Val Lys Asp
        115                 120                 125

Leu His Leu Pro Val Thr Cys Val Asp Ala Thr Glu Gln Phe Leu Ser
    130                 135                 140

Lys Leu Lys Gly Val Val Asp Pro Glu Arg Lys Arg Lys Ile Ile Gly
145                 150                 155                 160

Ala Glu Phe Ile Ala Val Phe Asp Glu Phe Ser His Arg Leu Glu Arg
                165                 170                 175

Glu Ile Gly Lys Met Pro Ala Phe Leu Val Gln Gly Thr Leu Tyr Pro
            180                 185                 190

Asp Val Ile Glu Ser Cys Pro Pro Pro Gly Ser Gly Lys Ser His Ser
        195                 200                 205

His Thr Ile Lys Ser His His Asn Val Gly Gly Leu Pro Glu Asn Met
    210                 215                 220

Lys Leu Lys Leu Val Glu Pro Leu Lys Trp Leu Phe Lys Asp Glu Val
225                 230                 235                 240

Arg Glu Met Gly Ala Leu Leu Asp Val Pro Val Ser Phe Leu Lys Arg
                245                 250                 255

His Pro Phe Pro Gly Pro Gly Leu Ala Val Arg Ile Leu Gly Asp Val
            260                 265                 270

Thr Gln Asp Gly Ala Leu Asp Thr Ile Arg Leu Val Asp Glu Ile Phe
        275                 280                 285

Val Asn Ser Ile Arg Glu Ala Gly Leu Tyr Asp Lys Ile Trp Gln Ala
    290                 295                 300
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Phe Ala Val Tyr Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp Lys
305 310 315 320

Arg Thr His Ser His Ala Val Ala Leu Arg Ala Ile Thr Ser Glu Asp
325 330 335

Gly Met Thr Ala Asp Trp Phe His Phe Asp Gly Lys Phe Leu Ala Glu
340 345 350

Val Ser Ser Lys Ile Cys Asn Ser Val Arg Gly Ile Asn Arg Val Val
355 360 365

Tyr Asp Ile Thr Ser Lys Pro Pro Ser Thr Val Glu Trp Glu
370 375 380